Patent
Attorney's Docket No. 032899-018

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	
Sean Linden	Group Art Unit: 3753
Application No.: 10/518,641	Examiner:
Filed: April 4, 2005	Confirmation No.: 5066
For: VALVE ASSEMBLY FOR OPENING AND CLOSING A FUEL LINE	

PETITION TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant hereby petitions to make this Application special under 37 C.F.R. § 1.102. The requisite fee under 37 C.F.R. § 1.17(h) is attached.

Pursuant to M.P.E.P. § 708.02, Subsection VIII, Applicant submits that a preexamination search was made in the corresponding International Application. A copy of the International Search Report is submitted herewith. The documents cited in the International Search Report were attached to the Information Disclosure Statement previously submitted April 4, 2005. In order to assist the Examiner, a revised PTO-1449 is attached herewith indicating that full translations of the foreign language documents and the International Search Report have been provided. The International Search Report indicates the degree of relevance of each cited document, as considered by the International Search Authority.

U.S. Patent No. 4,239,153 discloses a temperature responsive control device. The thermoresponsive subassembly 14 includes a sensor bulb 17 filled with a thermoresponsive substance and is connected with an axially shiftable elongated plunger 19 such that expansion of the substance with increasing temperature at the bulb causes extension of plunger 19 further into body 12.

In operation, a compressed gaseous fluid entering port 42 flows through opening 44', through port 40" into passage 40, around the upper end of the push rod

inside sleeve 50 to outlet port 50', and through port 52 to the shutter actuator to maintain the shutters closed on the radiator of the engine. As the engine coolant temperature increases, the substance in bulb 17 expands, extending plunger 19 which shifts push rod 28 into the body until nose 40' is closed by engagement with ball 58. This prevents further compressed air flow to the actuator of the shutter. Slightly more sensor expansion which increasing engine temperature causes push rod 28 to lift ball 58 from its seat 56, allowing the compressed air in the shutter actuator to vent through ports 62, thus allowing the shutter mechanism to open and allow cool air to flow through the radiator. If engine temperature increases even with the shutters open, push rod 28 will push ball 58 still further, thereby shifting plunger 64 against compression spring 86 until electrical contacts 80 and 72 engage; thereby allowing current flow to activate a warning signal.

The valve disclosed in U.S. Patent No. 4,239,153 does not disclose first and second regions adapted to be actuated by the pressure of a first pressurized fluid in the first region against a biasing means to open the first outlet, wherein the heat-sensitive sealing means in the second region fails at high temperature so as to de-pressurize the second region, thereby actuating the valve to move under the biasing means to close the first outlet and seal the first region. The '153 patent also does not disclose a relay unit, which is arranged to sense a parameter, and react to the sensing of the parameter by actuating the valve to seal the first region, nor does it disclose a temperature-sensitive safety valve assembly which is remotely, wirelessly, electronically operable.

GB 811,022 discloses a valve body 1 having a cover with a central opening 10. The opening 10 has its outlet in an hermetically sealed chamber 17 and joined by a capillary tube 18 with a bulb 19 which is arranged in heat-transfer relationship on the engine block. The bulb 19 contains a liquid which upon reaching a particular temperature undergoes a change a state and becomes steam. The steam pushes against a diaphragm 13 such that valve closure member 14 is pushed against its seat 3 and the communication between the ports 2 and 4 is interrupted, and fuel can no longer be supplied to the engine.

GB 811,022 fails to disclose a valve between first and second regions adapted to be actuated by the pressure of a first pressurized fluid in the first region against a biasing means to open the first outlet, wherein the heat-sensitive sealing means in the second region fails at high temperature so as to de-pressurize the second region, thereby actuating the valve to move under the biasing means to close the first outlet and seal the first region. GB 811, 022 also does not disclose a relay unit, which is arranged to sense a parameter, and react to the sensing of the parameter by actuating the valve to seal the first region, nor does it disclose a temperature-sensitive safety valve assembly which is remotely, wirelessly, electronically operable.

FR1147137 discloses a valve device which automatically opens a pressurised gas cylinder associated with it when the device is immersed in water, for subsequent inflation of a life jacket or inflatable dinghy or the like.

Referring to Figures 1 and 2, the valve device comprises a hollow tubular body 1 mounted on a seat 2 screwed to an output nozzle 3 of a compressed gas cylinder. The seat 2 of the device has a channel 5 situated facing the outlet nozzle 3 of the compressed gas cylinder. Another channel 6 fluidly connects the channel 5 to a third channel or nozzle 7, on which can be fitted a pipe or device to receive compressed gas from the gas cylinder.

In the tubular body 1 is mounted a sliding piston 8, the lower end of which carries a perforator punch 9 intended to tear a seal 4 so as to close nozzles 3 of the cylinder. The end of the punch 9 has an elbowed channel 10 which allows direct communication between the output nozzle and the channel 6 of the seat when the seal 4 is torn (as shown in Figure 2). The upper end of the piston 8 is subject to the action of a coil spring 11 mounted between the upper end of the piston 8 and an inner face of the hollow body 1. The piston 8 comprises an inner axial bore 12 in which is arranged a metal peg 13, which extends out of the piston and the end of the hollow body 1. Between the lower end 13b of the peg and the base of the piston 8 is arranged a coil spring 14 which tries to push the peg 13 upwards. The piston 8 tubular wall has bores at an upper part thereof. In each bore is arranged a ball 15, the diameter of which is greater than the thickness of the piston wall. The inner wall

of the hollow body 1 comprises a circular groove 16, intended to receive the face of the balls 15 when the device is in the waiting position shown in Figure 1, because the balls are pushed outwardly by part 13c of the peg 13.

In the waiting position shown in Figure 1, the upper end 13a of the peg 13 rests against a pellet 17 of a material which rapidly dissolves in water. This pellet 17 is sandwiched in place by a cover 18 screwed to the end 1a of the hollow body 1, and fitted with several perforations 19 to allow water ingress. In order to put the device into a functioning state, a transverse removable pin 20 is provided which allows momentary immobilisation of the peg 13 in Figure 1. The peg 13 is then held in the waiting position only by its support on the dissolving pellet 17. In this position, the piston 8 is however held immobilised due to the clamping of the balls 15 in a circular groove 16 of the body 1. As soon as the device comes into contact with water, the pellet 17 dissolves such that the peg 13 is no longer held immobilised and it moves upwardly under action of the spring 14. Part 13d of small diameter then faces the balls 15, meaning the balls fall out of the groove 16, such that the piston 8 is no longer locked in place. Hence the spring 11 can push the piston violently downwardly causing the punch 9 to perforate the seal 4. Thus, compressed gas can flow from the nozzle 3 of the cylinder to the channel 6 in the seat 2.

The valve disclosed in FR1147137 is not activated by pressurised fluid. Furthermore, FR1147137 does not employ a relay unit to sense a parameter and react to the sensing of such a parameter by actuating the valve, the valve is not wirelessly remotely operable and it is not powered by a solar cell.

FR2334032 discloses a trigger valve 12 for a fire extinguisher installation. The trigger valve 12 functions by detecting a fall in the air pressure of the installation due to the opening of one or more sprinkler heads 2. An air compressor 50 pressurises extinguisher pipes 1 and the pipes are linked by an air pipe 13 (Figure 1) to an inlet 14 of the trigger valve (Figure 2). When the sprinkler heads 2 burst due to the heat of a fire, the air pressure above a diaphragm 17 in a valve 12 decreases. When the air pressure above the diaphragm 17 is less than the pressure necessary for a valve plate 18 to rest on its seat 19 against the water pressure predominating at the opening 19a, water is released from a water supply pipe 11 to a water

discharge 21. Once water can escape via discharge 21, the water pressure predominating in pipe 11 and pipe 8 decreases. That pressure decrease enables a screw 6 in a cylinder 7 to freely move causing a leaf 5 of a valve to be released, so as to allow water to flow into the extinguisher assembly as it is required to douse a fire or the like.

FR2334032 does not disclose a relay unit which senses a parameter and reacts to the sensing of the parameter by actuating a valve. FR2334032 is not wirelessly and remotely operable and it is not powered by a solar cell.

* *

All the requirements for this petition having been met, Applicant respectfully requests that this application it be granted special status.

Respectfully submitted,

BUCHANAN INGERSOLL PC

Date: September 13, 2005

By: Wendi Weinstein
Wendi Leigh Weinstein
Registration No. 34,456

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

Substitute for form 1449A/PTO & 1449B/PTO

FIRST INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	10/518,641
Filing Date	December 20, 2004
First Named Inventor	Sean Linden
Examiner Name	
Attorney Docket Number	032899-018

U.S. PATENT DOCUMENTS

Examiner Initials	Document Number	Kind Code (if known)	Name of Patentee or Applicant of Cited Document	Issue/Publication Date (MM-DD-YYYY)
	4,239,153		Cadwell	12-16-1980

FOREIGN PATENT DOCUMENTS

Examiner Initials	Document Number	Kind Code (if known)	Country	Date of Publication (MM-DD-YYYY)	STATUS: Translation	Partial Translation	Eng. Lang. Summary	Search Report	IPER	Abstract	Cited in Spec
	811 022		Great Britain	03-25-1959				*			
	2 334 032		France	07-01-1977	*			*			
	1 147 137		France	11-19-1957	*			*			

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
	Copy of International Search Report for PCT/GB03/02422

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with M.P.E.P. § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to Applicant.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/02422

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16K17/38 F16K31/385

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 811 022 A (ALBERT JOLY) 25 March 1959 (1959-03-25) page 1, line 62 -page 2, line 25; figure 1	1,7,14, 21,24
A	FR 2 334 032 A (DUNLOP LTD) 1 July 1977 (1977-07-01) page 4, line 35 -page 7, line 31; figures	1
A	FR 1 147 137 A (SPENGLER RENE;ROTH ROGER) 19 November 1957 (1957-11-19) page 1, right-hand column, line 16 -page 4, right-hand column, line 17; figures	1,2,6
A	US 4 239 153 A (CADWELL RONALD G ET AL) 16 December 1980 (1980-12-16) column 5, line 66 -column 6, line 3	1,3

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 October 2003	15/10/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Girbés Fontana, M-V

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.
PCT/GB 03/02422

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
GB 811022	A	25-03-1959	NONE		
FR 2334032	A	01-07-1977	FR	2334032 A1	01-07-1977
FR 1147137	A	19-11-1957	NONE		
US 4239153	A	16-12-1980	AT	6314 T	15-03-1984
			AU	525542 B2	11-11-1982
			AU	5035379 A	03-07-1980
			BR	7906766 A	14-10-1980
			CA	1148517 A1	21-06-1983
			DE	2966691 D1	22-03-1984
			EP	0013097 A2	09-07-1980
			ES	484425 A1	16-04-1980
			JP	55092910 A	14-07-1980
			MX	147680 A	04-01-1983
			PT	70293 A	01-11-1979
			TR	21494 A	12-07-1984

TRANSLATION OF FR 1147137

The object of the present invention is an automatically opening valve functioning under the effect of a variation or difference in ambient physical state to then open a pressurised gas pipeline or cylinder. Thus the valve device can be applied to a pressurised gas cylinder associated with a life jacket or inflatable dinghy which must be inflated by the gas of this cylinder when immersed in water. The device must then be designed to function automatically as soon as it is immersed in water in order to allow automatic inflation of the jacket or dinghy intended for example for aviators in case of an accident over the sea.

Devices for automatic opening of gas cylinders which function automatically on immersion in water have already been proposed. These devices comprise a perforator punch constantly subject to the action of a spring which is designed to push said punch violently against a tearable seal closing a gas cylinder, the punch however being retained by one or more pellets of material which dissolves in water, so that on immersion in water these pellets dissolve and the punch thus released perforates the seal and opens the gas cylinder. But these devices are not totally satisfactory and because of their very design, the violent action of the spring is exerted constantly on the dissolving pellets which risk breaking or accidentally failing under the effect of this pressure, which would cause sudden functioning of the device. In an attempt to avoid this disadvantage, generally not just one dissolving pellet is used but several stacked above each other. However this does not fully eliminate the drawback described and furthermore the action of the punch is delayed at the time of normal function as the dissolution of the various pellets cannot be completed at the same moment and the punch risks thus being slowed or stopped momentarily during its movement.

For this reason the object of the present invention is an automatic valve device designed to eliminate completely the drawbacks of the known devices and on the contrary offer a number of interesting advantages.

In fact the device essentially comprises a hollow body containing a mobile control element for the opening that is subject to the action of a spring but immobilised by the clamping of balls carried thereby and pushed against the inner wall of the hollow body by an internal axial peg continuously stressed in the direction of releasing the balls but retained by a dissolving pellet.

Where applicable at the site of the dissolving pellet can be provided a body or element able to be destroyed or eliminated on any other variation or difference in the ambient physical state, the possible applications of the device according to the invention not being limited to the case of function on immersion in water to control the inflation of life jackets or dinghies. The device can in effect be designed to control automatically the opening of a compressed gas cylinder projecting an extinguishing product on the start of a fire. It can also be designed for any other similar desired application for automatic function on a specific variation or difference in the ambient physical state.

But the main advantage of this device is the fact that the dissolving pellet or other sensitive element does not tolerate the violent pressure of the spring moving the opening control element for opening. In fact this pellet or other sensitive element simply holds the peg which can be stressed by relatively weak means, given that this need only move the peg slightly to release the balls clamping the control element. The device therefore functions at two times with a relay system, the pellet or other sensitive element holding the opening control element indirectly in the waiting position.

This opening control element may be either a perforator punch intended to tear the seal closing the pressurised gas cylinder or a piston controlling the outlet passage of a pressurised gas or an element directly or indirectly maintaining the clamping of such a piston in the closed position.

In a possible embodiment of the device the axial peg is stressed by a spring arranged at the base of the bore made in the opening control element, this bore

comprising an annular groove in its part which comes to face the balls after its displacement under the action of the spring.

In another possible embodiment the end of the peg opposite the pellet or sensitive element is conical and comes into contact with the balls, holding them clamped such that the reaction force constantly tries to repel the peg towards the pellet or sensitive element and the balls are released as soon as the peg is moved.

Other features and advantages of the device according to the invention will appear during the description below of some preferred embodiments of the device. The description is given with reference to the attached drawing as a purely non-limitative example on which:

Fig. 1 is an axial section view of a first embodiment of a device according to the invention;

Fig. 2 is a similar view of the same device depicted after its function;

Fig. 3 is an axial section view of a second embodiment of the device according to the invention;

Fig. 4 is an axial view of another embodiment combined with a sliding sealed piston valve for closing.

The device shown in figs. 1 and 2 comprises a hollow tubular body 1 mounted on a seat 2 intended to be screwed to the output nozzle 3 of a compressed gas cylinder closed by a tearable seal 4. The seat 2 of the device has a channel 5 situated facing the outlet nozzle 3 of the compressed gas cylinder. Another channel 6 connects the channel 5 to a third channel or nozzle 7 on which can be fitted a pipe or device of any type to receive the compressed gas from the cylinder on function of the device according to the invention.

In the tubular body 1 is mounted sliding a piston 8, the lower end of which carries a perforator punch 9 intended to tear the seal 4 closing the cylinder, the end of this perforator punch comprising an elbowed channel 10 allowing direct communication between the output nozzle of the cylinder and the channel 6 of the seat 2 of the device when the perforator has torn the seal 4 (see fig. 2). With regard to the upper end of the piston 8, this is constantly subject to the action of a coil spring 11 of particularly high force, this coil spring being mounted between this end and the inner face of the corresponding end 1a of the hollow body 1.

The piston 8 comprises an inner axial bore 12 in which is arranged a metal peg 13 which also extends outside the piston, the upper end 13a of this peg passing even the end 1a of the hollow body 1. Between the lower end 13b of this peg and the base of the piston 8 is arranged a coil spring 14 of relatively low force which thus tries to push the peg 13 upwards.

At its upper part the tubular wall of the piston 8 comprises perforations in each of which is arranged a ball 15, the diameter of which is greater than the thickness of this tubular wall of the piston 8. The inner wall of the hollow body 1 comprises a circular groove 16 intended to receive the corresponding face of the balls 15 when the device is in the waiting position shown in fig. 1, these balls being pushed towards the outside by part 13c of peg 13. In fact this part 13c of the peg has a diameter equal to that of the bore of the piston 8. But between this part 13c and the lower end 13b, the peg 13 comprises a part 13d of smaller diameter.

In the waiting position shown in fig. 1, the upper end 13a of the peg 13 rests against a pellet 17 of a material which dissolves rapidly in water. This pellet 17 is held in place by a cover 18 screwed to the end 1a of the hollow body 1 and fitted with several perforations 19.

In order to put the device easily into a functioning state and position the dissolving pellet 17, a transverse removable pin 20 is provided which allows momentary immobilisation of the peg 13 in the position of fig. 1. It is then very easy to position

the dissolving pellet 17 and screw on the cap 18 when the action of the spring 13 is eliminated.

When the device must be ready to function the removable pin 20 must be withdrawn so that the peg 13 is held in the waiting position shown in fig. 1 only by its support point on the dissolving pellet 17. In this position the piston 8 carrying the perforator punch 9 which is constantly subject to the violent action of spring 11 is however held immobilised due to the clamping of the balls 15 in the circular groove 16 of the hollow body 1. This clamping is due to the pressing of the balls 15 towards the outside by the part 13c of peg 13 which in turn is held by its support on the pellet 17. The set of elements of the device is thus held perfectly in the waiting position shown in fig. 1.

However as soon as the device comes into contact with the water, the pellet 17 dissolves as the water can penetrate through the perforations 19 of the cap 18. As soon as the dissolution begins, the central perforation of the pellet 17 expands sufficiently and the pellet disintegrates such that the peg 13 is no longer held immobilised and on the contrary moves upward under the action of the spring 14. Part 13d of small diameter of this peg then comes to face the balls 15 which are therefore no longer held in the groove 16. The balls 15 can then move towards the inside such that the piston 8 is longer locked and the spring 11 can push it violently downward causing perforation of the seal 4 by the punch 9. Thus the compressed gas cylinder is opened and the gas can pass into the channel or device connected to the seat 2.

Fig. 3 shows another embodiment of the same device which is of particularly compact design. To this end the spring 14 is eliminated and its role is performed by the reaction effect of the balls 15 on the axial peg itself. This peg 23 is clearly different from the peg 13 of the previous embodiment. In fact it is much shorter and its lower end 23a is conical, this end being intended to itself push the balls 15 towards the outside in the circular groove 16 of the hollow body 1. The peg 23 is held in the corresponding waiting position shown in fig. 3 still by means of the support of the upper end of the peg on the dissolving pellet 17.

In this embodiment, peg 23 is not stressed upward by a spring but merely by the reaction effect of the balls 15 on its conical end 23a. In fact as soon as this device is immersed in water, the pellet 17 dissolves so that the peg 23, no longer supported, moves upward under the effect of this reaction of the balls 15. The balls 15 can then return towards the centre such that the piston 8 is no longer locked and the spring 11 can push it violently downward, causing the punch 9 to perforate the seal of the cylinder.

Thus this second embodiment functions in as satisfactory a manner as the first but takes up far less space, as the elimination of the spring 14 allows a considerable reduction in the length of the piston 8 and that of the hollow body 1 itself. Preferably the device can also comprise a manual control. This manual control can comprise simply a cord 21 attached to the peg 23 and extending towards the outside. Pulling this cord in effect causes the movement of the peg 23 past the pellet 17 and hence the balls 15 are released and the piston 8 moves. Advantageously the cord 21 cannot be attached directly to the peg 23 but can be fixed firstly to a cutter or punch 22 arranged on the inside of the bore 23b of the peg 23 and intended to cut or break the pellet 17. In this case the end 21a of the cord 21 is still attached to the peg 23 but a certain additional length of the cord is provided between the cutter 22 and the point of attachment on the peg 23. Thus by pulling on the cord 21 firstly the perforation and cutting of the pellet 17 is achieved by the cutter 22 without moving the peg 23. When the cutter 22 has passed through the pellet 17 the cord 21 can be pulled violently without meeting further resistance so that at the moment when the cord 21 is fully extended, the peg 23 is pulled violently towards the outside.

In both embodiments just described the control element for opening the compressed gas cylinder is a perforating punch intended to tear a seal closing the cylinder, this punch being carried via the piston 8. However it is evident that the device according to the invention can comprise any other opening control element associated with the piston 8 or constituted by the piston 8 itself. Thus the lower end of this piston can directly or indirectly control the opening of a pressurised gas outlet passage, the

movement of the piston 8 being reversed where applicable by changing the position of the spring 11.

Thus fig. 4 shows a new embodiment of this device where the position of the spring 11 is reversed so as also to reverse the movement of the piston 8. This embodiment is similar to that shown in figs. 1 and 2 as the axial peg fitted inside the piston 8 is pushed upward by a coil spring 14 of low strength mounted between the base of the piston 8 and the lower end 13b of this peg. The peg still comprises the two parts 13c and 13d of different diameters and its upper end 13a rests on the pellet 17 in the waiting position.

As already indicated the pressure spring 11 of high strength acting on the piston 8 is not arranged between the upper end of this piston and the corresponding end of the hollow body 1 but between a shoulder 8a of the piston and the seat of the device such that the piston 8 is pushed violently upward and not downward.

In the example shown the device is associated with a valve of the type of that which is the object of French patent number 1.071.320 of 30th December 1952 for a "Valve intended to control the flow of a pressurised fluid". Under these conditions the seat of the device according to the present invention is replaced by the cap 24 of this valve, the hollow body 1 being screwed directly to the upper end of the cap. Also the lower end of the piston 8 carries a finger 25 which constitutes the control pin for the valve concerned.

The pin 25 holds two balls 26 clamped against the cap 24 of the valve, which immobilises the sealed piston 27 closing the valve. The piston is then applied against a seat 28 and closes tightly the communication between an output channel 29 for compressed gas and a nozzle 30 opening to the outside.

It is evident that when the pellet 17 dissolves on contact with water, the peg 13 moves upward under the effect of the spring 14, releasing the balls 15. The piston 8 is then unlocked and it is pushed energetically upward under the action of the spring 11. The pin 25 is then drawn upward and the balls 26 can move closer together

which allows piston 27 to rise under the action of the pressure of the compressed gas. This gas can then pass from channel 29 to the outlet nozzle 30.

Naturally the piston 8 could be associated with any other control element for opening the passage of compressed gas. Also the device according to the invention can be associated with any desired device which is to receive pressurised gas under specific conditions, for example a life jacket or dinghy to be inflated automatically on immersion in water. However the device according to the invention can have any other applications, the dissolving pellet 17 then being replaced by another pellet or element sensitive to other variations or differences in ambient physical state. For example the device could be designed to function at the start of a fire, the pellet 17 that dissolves in water being replaced by a pellet that melts under the effect of heat. The device could then control the opening of a compressed gas cylinder ensuring projection of an extinguisher product onto a seat of fire, or a water spray or extinguisher fluid. The pellet 17 can again be replaced by a manometric capsule functioning on a specific difference in pressure of the ambient atmosphere. Similarly in general the pellet 17 can be replaced by any other element or device able to be destroyed or deformed or eliminated on a variation or specific difference in the ambient physical state. This element or device can also form part of an appropriate detector system of varying complexity depending on case and application.

It is evident that the object of the invention is not limited to the embodiments described and depicted and that any modification in form or detail may be made without leaving the framework of the present invention.

TRANSLATION OF FR 2334032

The present invention relates to trigger valves and more particularly but not exclusively trigger valves for extinguisher installations intended to fight fires, in particular installations intended to be used in low temperature environments.

Extinguisher installations are known in which pipework liable to freeze is filled with compressed air. A dry pipe valve or water retaining valve is used to retain the flow from the pressurised water source and release the water only when a fire is detected. These valves can function by means of differential valve seat zones or by mechanical means using levers and pistons. These valves function by detecting a fall in the air pressure of the installation due to opening of one or more sprinkler heads and typically are set to come into action when the air pressure falls to a fixed proportion, typically one-sixth, of the water pressure.

These known installations are susceptible to delay before the water retaining valve opens and the water sprays from the sprinkler heads which have opened, and when there is substantial volume of pipework the delays can be sufficiently long to reduce the effectiveness of the installation or assembly for limiting the propagation of the fire. To accelerate the operation, accelerators or exhausters are known which rapidly open the main valve. However the known accelerators require regular specialist maintenance and can undesirably release the water retaining valves or function slowly.

The object of the present invention is a trigger valve for a water retaining valve which once positioned cannot be released manually and which once triggered by a pressure falls allows rapid activation of all extinguishers.

According to a first aspect of the invention a trigger valve comprises pressure detection means intended to detect the pressure of gas in a gas pipe, a release valve controlled by the pressure detection means such that when the pressure detection means detect a fall in pressure to a predetermined level, the release valve

acts causing a relatively rapid fall in gas pressure, and an actuator valve activated by the relatively rapid fall in gas pressure to modify the pressure in a fluid pipe.

According to another aspect of the invention a trigger valve that is intended to control a water retaining valve activated hydraulically for a set of extinguishers comprises a valve actuated by air pressure that is intended to control a hydraulic pressure source to actuate the water retaining valve and pressure detection means controlling an air evacuation valve or rapid release valve such that when the air pressure in the set of extinguishers diminishes due to opening of an extinguisher at a predetermined pressure actuating the pressure detection means, the air valve opens and the loss of air pressure actuates the valve controlled by the air pressure, causing a variation in hydraulic pressure which opens the water retaining valve to send water to the extinguishers.

The air pressure detection means and release valve are preferably of one piece and can comprise a piston sliding in a cylinder, the piston being subjected to the action of the spring acting against air pressure, an air orifice through the piston and a valve lifter which is received in the air orifice and closes this when the air pressure is applied to the piston, such that when the air pressure falls below a predetermined value the piston moves under the action of the spring, leaving the lifter, and allows the air to pass through the orifice and escape.

Preferably a flap valve (unidirectional valve) is present between the release valve and the extinguisher pipe. Thus the air behind the flap valve can be evacuated very quickly such that the valve controlling the hydraulic pressure opens rapidly.

The lifter of the air pressure detector is held initially in tight contact with the air orifice by a shaft under the action of a spring comprising a unidirectional coupling which allows the shaft to move with the piston in the direction opposite the piston spring but which does not allow the return travel unless the coupling is held uncoupled. Preferably the coupling is released manually by means of a reset lever. The coupling can comprise a plate with an opening through which the shaft passes, a support rod on one side of the plate and a spring acting between the plate and the shaft, the

plate being pushed such that the opening receives the shaft and prevents its movement in one direction as required.

The piston spring is preferably adjustable to allow precise presetting of the air pressure of the trigger device. This can be achieved by adjusting the load of the piston spring by means of spacer shims. The piston is preferably cylindrical and comprises a sealing ring. Radial air outlets beyond the joint can appropriately constitute air exhaust passages in the direction of the atmosphere from the air orifice. The cylinder is preferably adjacent to the valve actuated by the air pressure and preferably in the same valve body. The valve actuated by the air pressure can be a slide valve but is preferably a diaphragm valve comprising a sealing diaphragm which is held against a circular seat by the compressed air pressure. In this case the air chamber located above the diaphragm is linked to the compressed air intake pipe and the valve actuated by the diaphragm is linked to a source of pressurised hydraulic fluid which keeps the water retaining valve closed. Thus the opening of the diaphragm valve allows evacuation of the pressure of the hydraulic source and the water retaining valve is released, and water can pass into the extinguisher assembly.

According to another aspect of the invention an extinguisher installation comprises a water retaining valve which can be actuated to send an extinguishing agent to a pipe system containing sprinkler heads, and means for maintaining the gas under pressure in said pipe system despite any leaks under normal conditions when the sprinkler heads are in the closed position, a trigger valve mechanism reacting to a possible reduction in gas pressure due to the opening of a sprinkler head to provoke a subsequent relatively rapid reduction in said gas pressure, and a water retaining valve control mechanism to open said valve in response to said subsequent relatively rapid reduction in gas pressure.

Also recommended is an extinguisher installation comprising a water retaining valve released hydraulically and a trigger valve according to the invention.

The figures on the attached drawing given as a non-limitative example clearly show how the invention can be implemented.

Figure 1 shows an extinguisher installation according to the invention.

Figure 2 shows in cross section a detail of the trigger valve used on figure 1 in the actuated position to allow evacuation of the air.

The set of extinguishers or extinguisher installation in figure 1 comprises fixed pipe system 1 containing heat-sensitive sprinkler heads 2 arranged in a building as required. A riser pipe 3 comprises a water retaining valve 4. This valve 4, indicated purely schematically, comprises a valve leaf 5 which is normally held in the closed position, so that the water does not enter the fixed pipe system 1, by means of a screw 6 held in contact with the leaf 5 by a hydraulically actuated piston-cylinder assembly 7. The assembly 7 is linked by pipes 8 and 9 to the riser pipe pressurising the water. Pipe 9 comprises a choke orifice 9a and is linked by a T-connection 10 and another pipe 11 to a trigger valve 12. The pipe system 1 is also linked by an air pipe 13 to an inlet 14 of the trigger valve 12 and a flap valve 51 is interposed between the sprinkler heads and the pipe 13 to prevent water flowing towards the trigger valve 14 and an air compressor 50 when water is sent to the sprinkler heads 2.

The trigger valve 12 is shown in detail on figure 2 and comprises a cover 15 screwed to a body 16. A circular rubber diaphragm 17 supporting a valve plate 18 is clamped at its edge between the cover 15 and the body 16, and the body 16 comprises a valve seat 19 placed below the valve plate 18. The water supply pipe 11 is linked to an opening 19a located below the valve seat 19 and a passage 20 situated outside the valve seat 19 leads to a water discharge 21. The air inlet 14 is linked to a chamber 22 situated above the diaphragm such that the components described so far can function as a control valve for water in the pipes 8 and 11 connected together, water being released when the air pressure above the diaphragm is less than the pressure necessary for the valve plate 18 to rest on its seat against the water pressure predominating at the opening 19a.

An air passage 23 departing from the chamber 22 leads to a cylindrical bore 24 formed in the cover 15. A piston 25 comprising an annular sliding sealing joint 26 towards its lower end is seated with gentle friction in the cylindrical bore 24. The piston 25 is returned downward in its bore 24 by a compression spring 27 placed in the pipeline inside a cylindrical chamber 28 formed behind the piston 25. The spring 27 rests against an end seal 29 which is screwed into the body 16 to retain the piston. Spacer shims 30 are placed between the piston 25 and the springs 27 to allow adjustment of the force exerted by the spring on the piston 25. An axial air orifice 31 machined through the end face of the piston comprises a valve seat 32 machined in the edge adjacent to the chamber 28. A lifter 33 which is seated with gentle friction in an axial support hole 34 machined in the end seal 29 comprises a conical end face which makes contact with the valve seat 32 as will be explained below. Radial air holes 35 are formed in the piston skirt to allow air to escape from the chamber 28 and an exhaust orifice 35a links the holes 35 to atmosphere.

A valve cap 36 is coupled by screw joint to the end seal 29. A cylindrical shaft 37 slides in a bearing 38 formed in the cover 36 and comprises an enlarged head 39 and a compression spring 40 acting against the head 39 to exercise a downward pressure on the shaft 37 as has been shown, such that the head 39 comes into contact with the lifter 33. The upper end of the shaft 37 protrudes into a recess 41 formed in the cap 36 and a removable coupling mechanism 42 touches said upper end.

The removable coupling mechanism 42 comprises a plate 43 with a hole slightly larger than the diameter of the shaft. The plate 43 is returned downward, slightly resiliently, along the shaft 37 via a spring 44 in coaxial contact with an end stop 45 fixed to the end of the shaft by a screw 46. One of the ends 47 of the plate 43 is prevented from moving in the direction of the axis of the shaft 37 by a reset pin 48 acting as a support rod in contact with the base of the recess 41. Thus the spring 44 causes the plate 43 to swivel and the hole receives the rod and prevents continuation of the downward movement under the action of the spring 40.

A dust cap or hood 49 completes the trigger valve.

The valve functions as follows. The head of the reset pin 48 is manually pushed to the right (on figure 2) to release the coupling 42 such that the shaft 37 loaded by the spring applies the lifter 33 to its valve seat 32. A small air compressor 50 of the type conventionally used in air-filled extinguisher assemblies is then connected and used to pressurise the extinguisher pipes. The flap 5 of the water retaining valve 4 closes under the action of its own weight. The water pressure at this stage is held remote from the riser pipe 3 by a stop valve operated manually (not shown).

The increasing air pressure causes the piston 25 to rise in its bore 24 and carry the lifter 33 and shaft 37 such that the shaft slides up into the hole of the plate 43 of the coupling 42 against the pressure of springs 40 and 27.

The coupling 42 allows the piston 25 and lifter 33 to rise until the piston 25 and lifter 33 touch the end seal 29. The trigger valve is then in permanent function mode and the actuation of the reset pin has no effect, the coupling blocking again immediately, and the shaft 37 is held in position.

When the air pressure is sufficiently high to hold the diaphragm against the water supply pressure predominating below it, the water inlet valve can be opened to allow water to penetrate the hydraulic cylinder 7 and below the leaf 5 of the water retaining valve. The water pressure predominating in the pipes 11, 9 and 8 holds the screw 6 in place.

The function of one or more sprinkler heads 2 allows the air to escape from the assembly much more quickly than the small compressor can compensate for this, and the water pressure in the pipe system diminishes. At an air pressure determined by the load of the spring 27, the piston 25 descends, the lifter 33 being held against the head 39 of the shaft 37 by air pressure, such that the valve opens at the seat 32. This resulting position of the piston 25 and lifter 33 is shown on figure 2. The air can thus escape via 35a and the pressure in the pipes diminishes rapidly. As soon as the air pressure becomes insufficient to hold the valve plate 18 against its seat 19, the water in the pipe 11 can escape via the orifice 21 at a greater speed than that at

which it could penetrate the pipe through the orifice 9a, and the resulting pressure fall in the pipe 8 actuates the cylinder 7 and releases the leaf 5. Water then penetrates the extinguisher assembly as required.

The reset can be achieved by repeating the above once the water has been evacuated from the pipes. Thus the head of the reset pin 48 is moved to the right (on figure 2) to release the coupling 42 and allow the lifter 33 to be supported by the spring on the valve seat 32. The air and water pressures in the sections of the pipe system then undergo the cycle described above.

The trigger valve is set practically irrespective of water pressure in the main pipelines because the exhaust or rapid discharge of air after triggering of the piston 25 always rapidly releases the plate 18 of the water control valve. The trigger valve is only released when the head of the reset pin is pushed to the right. Thus once the compressor has begun, the installation can be left to adjust itself automatically and finally the device prevents unauthorised adjustment.

The invention can be incorporated in any other installation where a rapid opening valve is required which can be preset to open at any pressure.

Evidently modifications may be made to the embodiments just described, in particular by substituting equivalent technical means, without leaving the framework of the present invention.